



Description Logic

Summer Semester 2022

Exercise Sheet 8

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Exercise 8.1 Use the $\mathcal{ALC}$ -Worlds algorithm to decide satisfiability of the concept name A_0 w.r.t. the following simple TBox:

$$\begin{aligned} \{ & A_0 \equiv A_1 \sqcap A_2, & A_1 & \equiv \exists r.A_3, & A_3 & \equiv P, \\ & A_2 & \equiv A_4 \sqcap A_5, & A_4 & \equiv \exists r.A_6, & A_6 & \equiv Q, \\ & A_5 & \equiv A_7 \sqcap A_8, & A_7 & \equiv \forall r.A_4, & A_8 & \equiv \forall r.A_9, \\ & A_9 & \equiv \forall r.A_{10}, & A_{10} & \equiv \neg P \} \end{aligned}$$

Draw the recursion tree of a successful run and of an unsuccessful run. Does the algorithm return a positive or a negative result on this input?

Exercise 8.2 Determine whether Player 1 has a winning strategy in the following finite Boolean games, where in both cases $\Gamma_1 = \{p_1, p_3\}$ and $\Gamma_2 = \{p_2, p_4\}$:

- (a) $((p_1 \wedge p_3) \rightarrow \neg p_2) \wedge (\neg p_1 \rightarrow p_1) \wedge (\neg p_2 \rightarrow (p_3 \vee p_4))$
- (b) $(p_1 \vee \neg p_2) \wedge (p_2 \vee p_3) \wedge (\neg p_3 \vee \neg p_4) \wedge (\neg p_1 \vee \neg p_2 \vee p_3 \vee p_4)$

Exercise 8.3 Use the $\mathcal{ALC}$ -Elim algorithm to decide satisfiability of

- (a) the concept name A w.r.t. $\mathcal{T} = \{A \sqsubseteq \exists r.A, \top \sqsubseteq A, \forall r.A \sqsubseteq \exists r.A\}$.
- (b) the concept $\forall r.\forall r.\neg B$ w.r.t. $\mathcal{T} = \{\neg A \sqsubseteq B, A \sqsubseteq \neg B, \top \sqsubseteq \neg \forall r.A\}$.

Give the constructed type sequence $\Gamma_0, \Gamma_1, \dots$. In case of satisfiability, also give the satisfying model constructed in the proof of Lemma 5.10.